

REMARKS

Status of Claims

Claims 16-22 and 24-32 are pending. Claims 16-19 are withdrawn. Claims 1-15 and 23 are cancelled. Claims 20, 21, 24, 27, 28, and 30-32 have been rejected under 35 U.S.C. §102. Claims 22, 25, 26, and 29 have been rejected under 35 U.S.C. §103. Claims 20-22 and 24-32 remain for consideration upon entry of the present Response. No new matter has been added.

Claim Rejections – 35 U.S.C. §102

Claims 20, 21, 24, 27, 28, and 30-32 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 1,667,299 to Wildhaber (hereinafter “Wildhaber”). The Examiner alleges that Wildhaber discloses a profile-sharpened or profile-sharpened and additionally form-ground bar cutting blade as recited in claim 20. The Examiner also notes that while Wildhaber does not distinctly disclose that the clearance surfaces thereof are profile-sharpened, these surfaces are allegedly inherently capable of being ground in this way and, therefore, the clearance surfaces of Wildhaber allegedly meet the limitations of claim 20. The rejection is traversed for the reasons presented below, and reconsideration is respectfully requested.

For the reasons presented below, Wildhaber does not disclose a profile-sharpened or profile-sharpened and additionally form-ground bar cutting blade as recited in claim 20. Nor does Wildhaber disclose clearance surfaces that are inherently capable of being ground in a profile-sharpening fashion, as alleged by the Examiner.

Wildhaber discloses form-ground blades or form blades (terms used in the present patent application), which are referred to as relief-ground blades in the document titled “Spiral and Hypoid Bevel Gears Based on the Spiroflex Method,” by Erich Kotthaus (hereinafter “Kotthaus”), which is submitted in an Information Disclosure Statement filed with this Response to Office Action. Form ground blades or form blades are the same as relief-ground blades. The definition of form-ground or form blades is on page 605 of Kotthaus (column 1, in the explanation referring to Figure 12).

Form-ground blades include several defining characteristics. First, form-ground blades are characterized by the blade profile being curved and relief-ground such that the normal

profiles of the blades remain in place every time the rake surfaces of the blades are ground (Kotthaus, page 605, column 1, third paragraph, and in Figure 12 thereof).

Second, in form-ground blades, in order to cut as many teeth as possible per blade, the useful profile length is made to be as long as possible. Therefore, the space requirement of a blade on the circumference of the cutter head depends on the profile length of the blade and on the spacing between two adjacent blades to ensure sufficient clearance by the grinding disk used for sharpening. As this space requirement is increased, the performance of the cutter head becomes less suitable, as fewer blades can then be fitted in the same space. This means that fewer cuts are made per unit of time, and it accordingly takes an undesirably longer period of time to produce the form-ground blade. (Kotthaus, page 605, column 2, second paragraph.)

Third, the rake angle of a typical form-ground blade is 12-15 degrees, whereby the flank clearance angle is only about 3-4 degrees. This often results in less-than-suitable conditions for cutting bevel gears with the form-ground blade. (Kotthaus, page 606, column 2, third paragraph.)

Fourth, for form-ground blades, the tangent of the flank clearance angle is equal to the product of the tangent of the normal angle of pressure and the tangent of the head clearance angle. This presents a further restriction on the manufacture of a form-ground blade.

In contrast to Wildhaber, claim 20 recites profile-sharpened blades. Profile-sharpened blades (also a term used in the present patent application) are referred to by Kotthaus as Spiroflex cutting blades (Kotthaus, page 605, column 2, in the explanation referring to Figure 14; page 606, column 2, in the fourth paragraph (preceding the Summary section)). Profile-sharpened blades differ from form-ground blades (as in Wildhaber) for several reasons. First, the flank clearance angle can be selected independently of the head clearance angle (Kotthaus, page 606, column 2, fourth paragraph (preceding the Summary section)). This is in contrast to the form-ground blades of Wildhaber in which the tangent of the flank clearance angle is equal to the product of the tangent of the normal angle of pressure and the tangent of the head clearance angle.

Second, in general, the head clearance angle of a profile-sharpened blade is set to 8 degrees and the flank clearance angle is set to 7 degrees. These measures have a positive effect

on the service lives of the profile-sharpened blades and the surfaces cut on the tooth edges thereof. (Kotthaus, page 606, column 2, fourth paragraph.)

Third, profile-sharpened blades are simple and inexpensive. The service life of such blades is typically many times longer than that of the form-ground blades (Kotthaus, page 602, column 1, fourth and sixth paragraphs) as disclosed in Wildhaber.

Fourth, the profile-sharpened blades have a longer useful length than form-ground blades (as can be seen in a comparison of usable lengths in Figures 12 and 14 of Kotthaus, page 605), thereby saving space in the cutter head. After the cutting edges are worn down (Kotthaus, page 606, column 1, third paragraph), the blade rake surfaces of the form-ground blade are ground in accordance with Figure 12 until the wear mark has been removed. By contrast, if all cutting edge surfaces of the profile-sharpened blade are sharpened, as illustrated in Figure 14, the wear mark width is significantly reduced by grinding the flank surfaces of the blades. This means (for profile-sharpened blades) that only minor grinding of the rake surfaces is required.

Furthermore, as the blade profiles of profile-sharpened blades retain the same position relative to the shaft axis every time they are sharpened, the profile-sharpened blades can be employed in the cutter head without being radially adjusted to compensate for material removed in the sharpening process (contrary to the form-ground blades).

Fifth (as noted in Kotthaus, page 606, column 1), the profile-sharpened blades are arranged in groups, each of which consists of two final cutters (one for the concave flank surfaces and one for the convex flank surfaces). Clamping of two profile-sharpened blades in one groove, and the extremely small shaft cross section of the profile-sharpened blades, permits an extremely dense blade array. This means that the cutter heads can now be fitted with more blades with the same diameter, which in turn means that more cuts can be made per cutter head revolution. With regard to the profile-sharpened blades as recited in claim 20, one profile-sharpened blade replaces a group of two final cutters of the profile-sharpening cutting process and a form-ground blade of Wildhaber.

Additionally, it is not true that the clearance surfaces of the Wildhaber blade are inherently capable of being ground using profile-sharpening, as alleged by the Examiner. With a form-ground blade, the normal profiles remain in place every time the rake surface of the blades is ground (Kotthaus, page 605, column 1, third paragraph). A single grinding operation

performed on a form-ground blade as if the blade were a profile-sharpened blade would change the normal profile permanently so that it could not be used for milling the same gears (spiral and hypoid gears) as intended. As described above, this is clearly shown by a comparison of Figures 12 and 14 of the Kotthaus reference. As stated above, in a form-ground blade as in Wildhaber, the restriction must be observed that the tangent of the flank clearance angle must equal the product of the tangent of the normal angle of pressure and the tangent of the head clearance angle in order to avoid irreparably damaging the cutter.

Moreover, the specification of the present application refers to German patent DE 694 05 978 (of record in the present application), which discloses a bar cutting blade that is a “profile-sharpened” cutting blade where the top surface and the two clearance surfaces are ground to restore and sharpen the cutting blade. Other references also disclose profile-sharpened blades, for example, U.S. Patent No. 5,480,343 (which is of record in the present application) and U.S. Patent No. 5,305,558. Both U.S. Patent No. 5,480,343 and U.S. Patent No. 5,305,558 are directed to methods of sharpening profile-sharpened cutting blades. It is indicated, e.g., in U.S. Patent No. 5,305,558 (column 1, lines 17-21), that one example of cutting blades of the bar stock type are those blades known as “profile sharpened” blades. In these blades, the top surface, side profile surfaces, and the cutting face (in some types) are ground to restore and resharpen the blades. This same patent also refers (in column 1, lines 57-61) to U.S. Patent No. 4,265,053, which discloses form-ground profile-sharpened cutting blades of the type wherein along with the top surface and the side profile surfaces, the front face also requires grinding during sharpening. The foregoing patents are referred to to show that the technical terms “profile-sharpened” and “form-ground” have been previously acknowledged by the U.S. Patent Office.

Based on the foregoing, Wildhaber fails to disclose, teach, or suggest all the recitations of claim 20, namely, a profile-sharpened or profile-sharpened and additionally form-ground bar cutting blade for milling spiral bevel gears and hypoid gears comprising at least two clearance surfaces that can be ground to provide profile-sharpening, as recited in claim 20. In short, Wildhaber fails to disclose, teach, or suggest a profile-sharpened or profile-sharpened and additionally form-ground bar cutting blade, as recited in claim 20.

Because Wildhaber fails to disclose, teach, or suggest all the recitations of claim 20, claim 20 is not anticipated by the Wildhaber reference.

For at least the foregoing reasons, claim 20 is allowable, and Applicant respectfully requests that the Examiner withdraw the rejection of claim 20.

Dependent claims, by definition, further define the subject matter of the independent claims from which they depend. Because claims 21, 24, 27, 28, and 30-32 depend from claim 20, claims 21, 24, 27, 28, and 30-32 add recitations that further define the subject matter of independent claim 20. Because claim 20 is allowable for at least the reasons presented above, claims 21, 24, 27, 28, and 30-32 are therefore also believed to be allowable. Consequently, Applicant respectfully requests that the rejections of claims 21, 24, 27, 28, and 30-32 be withdrawn.

Claim Rejections – 35 U.S.C. §103(a)

Claim 22 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Wildhaber in view of U.S. Patent Application Publication No. 2001/0028831 to Iizuka et al.

Claims 25 and 26 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Wildhaber in view of U.S. Patent No. 5,944,587 to Stadtfeld.

Claim 29 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Wildhaber in view of U.S. Patent No. 3,760,476 to Kotthaus.

Because claims 22, 25, 26, and 29 depend from claim 20, and because claim 20 is non-obvious, claims 22, 25, 26, and 29 are likewise necessarily non-obvious. Applicant, therefore, submits that claims 22, 25, 26, and 29 are allowable. Accordingly, Applicant respectfully requests that the rejections of claims 22, 25, 26, and 29 be withdrawn.

Conclusion

Applicant believes that the foregoing remarks are fully responsive to the Office Action and that the claims herein are allowable. An early action to that effect is earnestly solicited.

If the Examiner believes that a telephone conference with Applicant's attorneys would be advantageous to the disposition of this case, the Examiner is invited to telephone the undersigned.

U.S. Serial No. 10/546,626
Response dated March 15, 2010
Reply to Office Action of September 14, 2009

Applicant's attorneys authorize the payment for the fees for the three-month extension fee and the IDS. If any additional charges are incurred with respect to this Response, they may be charged to Deposit Account No. 503342 maintained by Applicants' attorneys.

Respectfully submitted,

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